September 29, 2000

Mr. James Chang (SFD-8-1)
U.S. Environmental Protection Agency, Region IX
Federal Facilities Cleanup Branch
Air Force & DOE Section (SFD-8-1)
75 Hawthorne Street
San Francisco, CA 94105

Subject: Contract No. 68-W-98-220 / WA No. 220-11-Q7LW, George/Norton Air Force Base Work Assignment Review of the Draft Basewide Groundwater Monitoring Report Operable Units 1 and 3, April 2000 Event, dated September 2000

Dear Mr. Chang:

Enclosed is TechLaw's evaluation of the Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, April 2000 Event, dated September 2000. The Groundwater Monitoring Report was reviewed to evaluate the effectiveness of the OU 1 and 3 remedies. In addition, it was evaluated for inclusion of previous U.S. EPA comments on the prior year's, November 1999 Draft Final Basewide Groundwater Monitoring Report. The document was reviewed by Mr. Jim Cureton and a quality control review was performed by Ms. Indira Balkissoon.

This evaluation is being forwarded to you through electronic mail (via Internet) in WordPerfect® Version 8.0. A hard copy of the evaluation will also be submitted with this cover letter. TechLaw understands that you will review and augment the evaluation at your discretion.

Thank you for the opportunity to provide U. S. EPA with technical oversight services at George Air Force Base. TechLaw looks forward to working with you in the future. Should you have any questions, please call me at (415) 281-8730, ext. 14.

Sincerely,

Indira Balkissoon
Site Manager

copy: Angela Commisso, Region IX w/o attachment
P. Brown-Derocher/Central Files

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GEORGE AIR FORCE BASE
Victorville, California

Review of the Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, April 2000 Event George Air Force Base, California

Submitted to:

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Contract No.	**68-W-98-0220**
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Review of the Draft Basewide Groundwater Monitoring Report
Operable Units 1 and 3, April 2000 Event
dated September 2000
George Air Force Base

General Comments

1. The reinjection of treated groundwater at the percolation ponds appears to be causing TCE in groundwater to migrate to areas where no extraction wells are present. Reinjection of treated groundwater at the percolation ponds is chnaging the groundwater gradient in an easterly direction away from the percolation ponds. It appears that because of the change in groundwater gradient, concentrations of TCE in groundwater have significantly increased at monitoring well NZ-55, located east of the percolation ponds. Alternate discharge points for the treated groundwater at OU1 are not discussed in the Draft Basewide Groundwater Monitoring Report (the "Groundwater Monitoring Report"). Please revise the Groundwater Monitoring Report to include discussion of alternative discharge points for treated groundwater, including, but not limited to, the Victorville Valley Water Reclamation Authority facility located east of OU1.

2. The Draft Basewide Groundwater Monitoring Report does not discuss the distribution of TCE in both the shallow and deep portions of the upper aquifer. For instance, Figure 3-4 presents the distribution of TCE in groundwater in the upper aquifer, but concentrations of TCE in both the shallow and deep portions of the upper aquifer are contoured together. Section 3.2.1.1 does not discuss the distribution of TCE in the shallow and deep portions of the upper aquifer. The vertical gradient data presented in Table 3-7 shows that the shallow and deep portions of the upper aquifer have different hydraulic heads. It is not clear whether the extraction wells in the upper aquifer are addressing contamination in both the shallow and deep portions of the upper aquifer. It is also not clear whether the shallow and deep portions of the upper aquifer are in communication and whether they should be contoured together. Revise the Groundwater Monitoring Report to include analysis of the distribution of TCE in the upper and lower portions of the upper aquifer.

3. The tables and figures do not consistently present the locations of monitoring wells screened in the deep portion of the upper aquifer. It appears that there are at least ten monitoring wells screened in the deep portion of the upper aquifer (FT-2, MW-104, MW-106, NZ-6, NZ-20, NZ-22, NZ-30, NZ-31, NZ-32, and NZ-40). However, Figure 3-4 only marks four of these wells as being in the deep portion of the upper aquifer. Revise Figure 3-4 to indicate all wells screened in the deep portion of the upper aquifer. It would be helpful if the figures presented in the Groundwater Monitoring Report used different symbols for wells screened in the shallow and deep portions of the upper aquifer and for wells screened in the lower aquifer.

4. Two hot spots in the upper aquifer TCE plume are currently not being remediated by the extraction and treatment system. Two of the upper aquifer monitoring wells with the highest TCE concentrations (1280 μg/l at NZ-55, and 154 μg/l at NZ-39) are located in areas where there are no extraction wells. There are no upper aquifer extraction wells located downgradient of either NZ-55 or NZ-39. This is a concern because the TCE in groundwater will have to migrate to the lower aquifer to potentially be remediated by a lower aquifer extraction well. The closest lower aquifer extraction well to NZ-39 is located approximately 2000 feet away, and the closest lower aquifer extraction well to NZ-55 is located approximately 3500 feet away. Results of the Pre-Design Study did not predict TCE concentrations this high in either area, therefore modifications to the current extraction system appear to be warranted. The groundwater monitoring report does not provide any proposals or suggestions to improve mass removal at either monitoring well. Revise the groundwater monitoring report to address ways to improve mass removal of TCE in groundwater at monitoring wells NZ-55 and NZ-39.

5. The Air Force may want to consider combining the Process Monitoring Reports for OU1 with the Basewide Groundwater Monitoring Reports for OU1 and OU3. The reports provide complimentary information. Data, such as analytical results from extraction wells, from the Process Monitoring Reports would especially be helpful in the treatment system effectiveness evaluation provided in the Basewide Groundwater Monitoring Reports. Combining the reports semiannually, when the Basewide Groundwater Monitoring Reports for OU1 and OU3 are published, would also potentially provide cost savings on reporting.

6. It is unclear how background and compliance wells were selected for the OU3 landfill sites. It appears that sites DP-03 and DP-04 share one compliance well, site LF-12 has two compliance wells, and site LF-14 has three compliance wells. In addition all four landfill sites use the same well (RZ-02) as a background well. 40 CFR §258.51(a)(2) states that the point of compliance is to be established at a minimum at the waste management unit boundary or at a point that represents the quality of groundwater passing an established relevant point of compliance. However, it is difficult to determine the appropriateness of the compliance monitoring wells because the Groundwater Monitoring Report does not contain a figure showing the location of the monitoring wells in relation to the landfill sites and groundwater elevation contours. Please revise the Groundwater Monitoring Report to include the rationale for the location of the compliance and background monitoring wells at the landfill sites or provide a reference where the rationale may be found. In addition, Section 4.0 should include a figure showing the locations of the landfill sites and the compliance and background wells, and a table with the well construction data for the compliance and background monitoring well network.

Specific Comments

1. **Figure 3-6, Surface of the Upper Aquifer.** The groundwater elevation for monitoring well MW-103 is not included on the upper aquifer groundwater elevation contour map. According to Table 3-7, the groundwater elevation for monitoring well MW-103 was measured at 2737.50 feet, in April 2000. Please revise Figure 3-6 to present the groundwater elevation for MW-103. Groundwater elevation contours should also be revised to reflect the additional information.

2. **Table 3-7, Groundwater Elevation, April 2000 Sampling Event.** Table 3-7 does not present the elevations of the screen intervals for each of the monitoring and extraction wells. Without the screen intervals it is not possible to evaluate the vertical distribution of TCE in the upper aquifer nor to evaluate the relationship of screened intervals of extraction wells and nearby monitoring wells. Please revise Table 3-7 to include the elevations of the screen intervals of each monitoring and extraction well at OU1 and OU3.

3. **Table 3-8, Upper Aquifer Vertical Gradients.** Upper aquifer monitoring well pairs NZ-25/NZ-31 and MW-103/MW-104 are not included on Table 3-8. For completeness, the upper aquifer well pairs should be included on Table 3-8 for vertical gradient analysis.

4. **Section 4.2.1.2, TPH/VOC Sites, FT-19c, page 4-7.** The statement that the selected alternative for vadose zone soil at site FT-19c is protective of groundwater and is meeting the ROD objectives for protecting human health and the environment is inappropriate to include in this section. Since TCE is present in groundwater beneath the site, the data in the Groundwater Monitoring Report do not necessarily support the conclusion that the SVE system is protective of groundwater. The determination of whether the remedial system at FT-19c is protective of groundwater requires an evaluation of the FT-19c soil vapor extraction system. Please revise Section 4.2.1.2 of the Groundwater Monitoring Report to remove the statement that the selected alternative for vadose zone soil at site FT-19c is protective of groundwater and is meeting the ROD objectives for protecting human health and the environment. In addition, the Air Force should provide reference to the Semiannual Reports on Remedial Activities at FT-19c in Section 4.2.1.2.

5. **Appendix A, Well Purging Logs/Chain-of-Custody Forms.** Groundwater samples collected from several monitoring wells that exhibited significant drawdown during purging may not be representative of conditions in the upper aquifer. According to the well sampling logs in Appendix A, the groundwater levels at monitoring wells NZ-22, NZ-32, NZ-36, and NZ-59 showed drawdown between 2.4 and 5.5 feet. In order for the

micropurge method to work correctly, drawdown of the water column well needs to be minimal to ensure that the water purged is representative of the surrounding formation. The 3.2 feet of drawdown at monitoring well NZ-36 represents 7.7 liters of groundwater purged from the water column in the well. According to the purging logs, only 6.75 liters of groundwater were purged from NZ-36. Therefore, it is probable that the water being sampled at NZ-36 (and the other wells in question) is actually stagnant groundwater from the water column and not representative of conditions in the upper aquifer. The Air Force should modify the purging methods for the wells in question (e.g. lowering the purging rate or purging the well dry before sampling) during future sampling events. Also, the difference between the calculated purged volume and the purged volume recorded on the purging logs may be due to flow meter calibration problems. At a minimum, the flow meter should be calibrated once at the beginning of the day and checked at midday and at the end of the day.

Please note that in addition to the above comments, the Air Force should address U.S. EPA comments on the Draft Final Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999, dated August 2000. The comments are presented summarized below.

General Comments

1. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] Results presented in the Draft Basewide Groundwater Monitoring Report, Operable Units (OUs) 1 and 3, April 1999 Event indicate that the groundwater extraction system at OU 1 is not effectively removing TCE mass from the groundwater at OU 1. In general, decreasing trends are not observed in upper aquifer monitoring wells, indicating the upper aquifer plume is not decreasing in size. Also, the extraction system is not effectively removing TCE mass from the upper aquifer. The Air Force estimates that there is over 50 times as much TCE mass remaining in the upper aquifer as compared to the lower aquifer. According to Table 4.2 in the Draft Final Remedial Process Optimization Report for OU 1 (Parsons, 1999), the mass removal rate for the lower aquifer extraction wells is approximately 11 lbs/year, while the mass removal rate for the upper aquifer extraction wells is only approximately 7.8 lbs/year. Continuing extraction and treatment at these rates will likely result in a lengthy cleanup time. The Air Force should propose modifications to the current extraction system (e.g. focused extraction at hot spots) or provide the rationale for continued use of the existing extraction system.

   This comment has not been adequately addressed. It is recognized that the OU1 extraction system design included the reinjection of 872 gpm of effluent to the upper aquifer in order to recharge to the upper aquifer, and that without the reinjected water, extraction from the upper aquifer will not be efficient. However, it does not

seem efficient nor appropriate to extract large volumes of "clean" groundwater as the supply of recharge water to the upper aquifer. Additionally, the reinjection of water at the percolation ponds appears to be causing TCE in groundwater to migrate to areas where there are no extraction wells (i.e. near NZ-55). As stated previously, the Air Force should propose modifications to the current extraction system (e.g. focused extraction at hot spots) or provide the rationale for continued use of the existing extraction system.

Specific Comments

2. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] **Section 3.2.1.1, Upper Aquifer, page 3-6.** It appears that discharge to the percolation ponds is not enhancing the clean up of TCE in groundwater at OU 1. Discharge of treated groundwater to the percolation ponds is apparently causing portions of the OU 1 TCE plume to migrate to areas that are not captured by the extraction system (i.e. near well NZ-55). During the February 24, 2000 conference call U.S. EPA requested that the Air Force evaluate the cost of alternative discharge points for treated groundwater. The results of this analysis should be incorporated into future Groundwater Monitoring Reports.

This comment has not been adequately addressed. The Air Force states that the OU 1 groundwater extraction/treatment system is being operated based on the assumptions presented in the OU 1 Pre-Design Study (Montgomery Watson, 1995). However, data suggest that discharge to the percolation ponds is not enhancing the removal of TCE in groundwater. For instance, the OU 1 extraction system, does not appear to be addressing increasing TCE concentrations in certain areas, such as near monitoring well NZ-55. Monitoring well NZ-55 is located downgradient of the new percolation ponds. It does not appear that the Pre-Design Study modeling results predicted the significant increase in TCE concentration near NZ-55. Also, other assumptions presented in the Pre-Design Study contain inconsistencies with the data presented in the November 1999 Groundwater Monitoring Report. For instance, according to the OU 1 Pre-Design Study, Figure BII-60, the amount of TCE in the Lower Aquifer should be increasing due to migration of TCE from the upper aquifer to the lower aquifer (it was predicted that approximately 200 lbs of TCE would migrate to the lower aquifer in the first two years of operation of the enhanced extraction system). The Pre-Design Study estimates the initial TCE mass in the lower aquifer to be approximately 170 lbs, however, the November 1999 Event Groundwater Monitoring Report estimates the remaining TCE mass to be only 19.6 lbs. The results do not indicate that a significant amount of TCE has migrated from the upper to the lower aquifer. It is not clear that the OU 1 extraction system is operating as predicted and here is also evidence that infiltration at the percolation ponds is causing TCE in groundwater to migrate away from

existing extraction wells. Therefore U.S. EPA has requested that alternative discharge points be evaluated.

3. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] **Section 4.2.1.1, Landfill Sites, LF-12, page 4-4.** The Air Force monitored two compliance wells (NZ-60 and NZ-61) for LF-12, however, it is unclear whether either well is located downgradient of LF-12. Figure 3-14 indicates that groundwater flow direction in the vicinity of NZ-60 and NZ-61 may be to the south. Both wells are located to the east of LF-12, potentially cross gradient of LF-12. If the wells are cross gradient of LF-12, they will not be able to effectively monitor potential release from LF-12. Revise the Groundwater Monitoring Report to demonstrate the groundwater flow direction in the vicinity of LF-12 and to discuss the use of wells NZ-60 and NZ-61 as compliance monitoring wells.

This comment has not been adequately addressed. There does not appear to be an appropriately located compliance well at LF-12. The point of compliance is defined by California Code of Regulations, Title 27 as the vertical surface located at the hydraulically downgradient limit of the landfill unit that extends through the uppermost aquifer underlying the unit. Currently, there is no monitoring well located downgradient of LF-12. The Air Force is cautioned that before a Closure/Post-Closure Monitoring Plan can be approved for the George Air Force Base landfills, there must be appropriately located compliance monitoring wells for each landfill. New monitoring wells may need to be installed in areas where monitoring wells are not located downgradient of the landfills.

Previous General Comments

4. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, April 1999 Event*] The executive summary should cite when the "Water Quality Protection Standards" can be developed for the landfill sites or what is preventing their development if it is a planned delay.

[*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] This comment has been partially addressed. Section 4.1 has been revised to indicate that data is currently being collected to develop Water Quality Protection Standards (WQPS). The response should provide a time frame for when WQPS are anticipated to be developed for the OU-3 landfills.

This comment has not been adequately addressed. It is not clear from the response whether the November 1999 data is the final data needed to develop the Water Quality Protection Standards or if additional data will be required. Please clarify when the Air Force hopes to develop Water Quality Protection Standards.

5. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, April 1999 Event*] In the next OU1 groundwater sampling report with the November 1999 groundwater sampling event, GAFB should begin addressing mass removal along with data gaps resolution. For starters, propose a remedy for removing the TCE mass as this should be the primary focus of the project. The Multi-Phase Extraction technology for VOCs, a presumptive remedy, should be considered.

   [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] This comment has not been adequately addressed. The Air Force references the Pre-Design Study and indicates that the use of the percolation ponds is intended to assist in mass removal through flushing of the perched Upper Aquifer. However, data collected since startup of the extraction system indicate that the flushing approach is not efficiently removing TCE mass from groundwater. The Draft Final Remedial Process Optimization (RPO) Report for Operable Unit 1 produced by Parsons Engineering concluded that "the existing groundwater pump-and-treat system has been neither efficient nor effective in removing TCE mass from groundwater." The Draft Final RPO Report also concluded that "the likelihood of the pump-and-treat system achieving the cleanup goals or effectively meeting performance criteria within a reasonable time frame is questionable." George Air Force Base has not proposed or implemented any active solutions to address these concerns. The Air Force must consider modifications to the groundwater extraction and treatment system, including additional extraction wells or alternative extraction technologies, in order to address the inefficiency of the current system.

   This comment has not been adequately addressed. The Air Force has not addressed the concern that the OU1 groundwater extraction system is not effectively removing TCE mass from groundwater. This concern could be addressed by evaluating modifications to the existing groundwater extraction and treatment system, including additional extraction wells or alternative extraction technologies. Modifications to the existing groundwater extraction system do not have to be evaluated in a Feasibility Study or Engineering Evaluation/Cost Assessment. Proposed modifications could be evaluated in a technical evaluation report, and modifications that are implemented could be documented in an amendment to the Remedial Design Report.

Previous Specific Comments

6. [*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, April 1999 Event*] **Figure 3-1, TCE Concentrations in the Upper Aquifer - April 1999:** Concentrations of TCE have significantly increased recently from less than 50 μg/l to greater than 200 μg/l at monitoring well NZ-55. As indicated in Section

3.1.1.1, this TCE concentration is one of the highest in groundwater at OU-1. This is a concern because groundwater flow in the vicinity of NZ-55 is to the east (Figure 3-5), away from any extraction wells in the upper aquifer. The affected groundwater will likely migrate to the lower aquifer in an area where there is poor control of the groundwater flow direction, indicating that capture of this affected groundwater in the lower aquifer is uncertain. The Air Force must demonstrate that this portion of the groundwater plume will be contained in order to meet one of the objectives of the ROD, which is "to eliminate or reduce the potential for further migration of the existing TCE plume in groundwater". The Air Force should consider several actions to do this.

1. Installation of additional groundwater monitoring wells in the upper and lower aquifer to the north and east of NZ-55 (this area was identified as a data gap in the May 1999 George Air Force Base RPM meeting).
2. Minimization of effluent discharge in the new percolation ponds. The recharge from the ponds appears to be influencing the migration of the TCE groundwater plume to move to the east in the vicinity of NZ-55.
3. Groundwater extraction from well NZ-55.
4. Installation of additional groundwater extraction wells in the upper aquifer near NZ-55.
5. Installation of additional groundwater extraction wells in the lower aquifer to the east of NZ-55.

[*Previous Comment on Draft Basewide Groundwater Monitoring Report, Operable Units 1 and 3, November 1999 Event*] **This comment has been partially addressed. The installation of additional monitoring wells in the area north and east of NZ-55 will provide better definition of the TCE plume and the groundwater flow direction in the area north and east of NZ-55. The response does not address the concern that high concentrations of TCE in groundwater are migrating to an area where no extraction wells are present and that the migration of the TCE plume is being exacerbated by the discharge of treated groundwater into the percolation ponds. The Air Force must state why groundwater extraction in the vicinity of NZ-55 is not being considered and why additional groundwater extraction wells are not needed downgradient of well NZ-55. During the February 24, 2000 conference call the agencies requested that the Air Force conduct a cost benefit analysis for alternate discharge points of treated groundwater. Alternate discharge points should be investigated so as to minimize the migration of TCE north and east of NZ-55.**